Benchmark results for delayed neutron data

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We test the quality of the delayed neutron data in the most recent nuclear data libraries, by calculating the effective delayed neutron fraction ("beta-effective") for many benchmark systems. The results are obtained by means of a recently developed Monte Carlo method, which is implemented in a version of MCNP-4C3. A major advantage of this method is that it requires only a single run of MCNP to determine beta-effective. In fact, this is the same run with which one calculates k-effective. In doing so, the value for beta-effective is based directly on the nuclear data, without the need for additional pre- or post-processing. This enables fast and reliable computation of the effect of the delayed neutron data on beta-effective for many benchmark systems. We illustrate this point by presenting results for the most recent nuclear data evaluations available.

Moreover, this method gives values for the fundamental delayed neutron fraction, beta-0, and for beta-effective, in all available time groups (e.g. the traditional 6 groups, or, as is proposed for JEFF-3.1, 8 groups). By comparing results, based on different nuclear data evaluations, for beta-0 and beta-effective for all time groups, one can quantify the influence of both delayed neutron yield and delayed neutron spectrum for each time group.

This benchmarking effort ties in to other benchmarking work, such as for criticality, for spectral indices, and for shielding. We report results for these benchmarks as well, in order to work towards a more complete validation of nuclear data libraries.

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